Nobushige KATO*: On the variation of nodal types in the woody plants (1)

(A contribution to the nodal anatomy 1)

加藤信重*: 節型の変異 (1)

Introduction Since Sinnott reported the nodal types of angiosperms in 164 families covering 34 orders in 1914, many investigators thereafter studied the nodal types using the various plants. It is generally believed that the nodal region retains primitive features, and in fact the nodal type is usually definite within a genus, within a family in many cases, and even within an order in a few cases. Sinnott divided the angiosperms into three groups based on the nodal types, i.e. (a) unilacunar, (b) trilacunar, and (c) multilacunar types. He concluded that the trilacunar condition is the most primitive type. The fourth type, having one gap with two strands (a variety of the unilacunar type) which has hitherto been believed to characterize various groups of gymnosperms and ferns, was recently demonstrated to occur also at the foliage nodes in a number of dicotyledons. Besides there are many transitional forms connecting a, b, and c types. Howard (1962) reported many forms of nodal structure in relation to the vascularization of the petiole. It is also demonstrated by other students that the nodal types of cotyledons, first, second, and third leaves of seedlings are different from those of the upper leaves. Concerning these findings, it is important to verify for example that one type has actually been derived from the other. Up to this time, one species has been believed to have a definite nodal type in adult plants, and a variability of nodal types in one individual or in one species has not yet fully been examined. In this concern, the author studied various groups of plants, and some of the results are given below.

Material and Methods The materials used are branchlets of the year of *Lindera obtusiloba* Bl., *Rubus palmatus* Thunb. var. *coptophyllus* O. Ktz., *Sorbus commixta* Hedl., and *Poncirus trifoliata* Raf., collected by the author from March to June in 1965. Using specimens were fixed in 50% alcohol, serial sections were made at 20 μ, and stained with safranin and fast green.

Observations *Lindera obtusiloba* Bl. Usually two forms of the unilacunar

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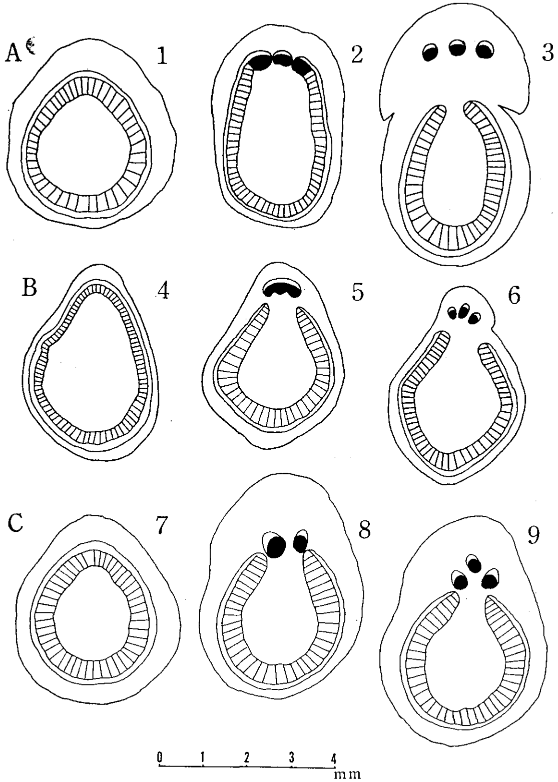

Fig. 1. ***Lindera obtusiloba*** **Bl.** Figures are drawn from transections of the nodal region, cut at successive levels from lower to upward. Xylem of stem crosslined, of departing leaf-trace strands solid black. A (1-3). Unilacunar type with three strands associating to a single gap. B (4-6). Unilacunar type with one strand dividing into three strands. C (7-9). Unilacunar type with one of the two strands dichotomizing, forming resultant three strands.

type are observed on the same plant. The commoner form is with three strands that are coming out from a single gap (Fig. 1 : A). The remaining is with one strand from a single gap, and the strand is divided into three at the junction with the petiole (Fig. 1 : B). Sometimes the author observed a form with two strands from a single gap (Fig. 1 : C). One of these two strands, however, is divided into two, so it looks like the commoner form shown in fig. 1 : A. These three forms described here are found randomly in the same branchlet.

Rubus palmatus Thunb. var. *coptophyllus* O. Ktz. In usual this species is

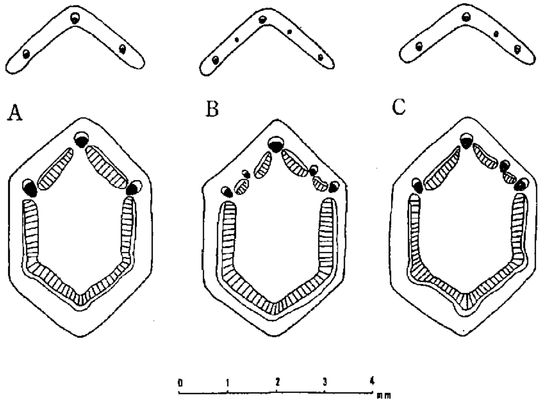

Fig. 2. *Rubus palmatus* Thunb. var. *coptophyllus* O. Ktz. A. Trilacunar type. B. Pentalacunar type. C. Tetralacunar type.

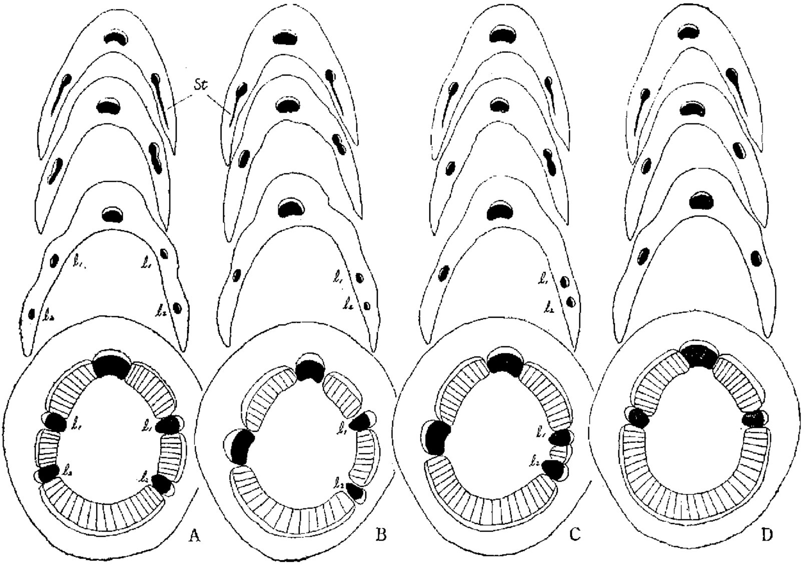

Fig. 3. *Sorbus commixta* Hed. A. Pentalacunar type. B, C. Tetralacunar type. D. Trilacunar type. l_1, l_2. lateral traces. st. stipular bundle.

of trilacunar type (Fig. 2 : A), but in some branchlets of an individual the pentalacunar type was observed (Fig. 2 : B). In this figure the upper two lateral traces are much smaller than the main and the lower two laterals. In some

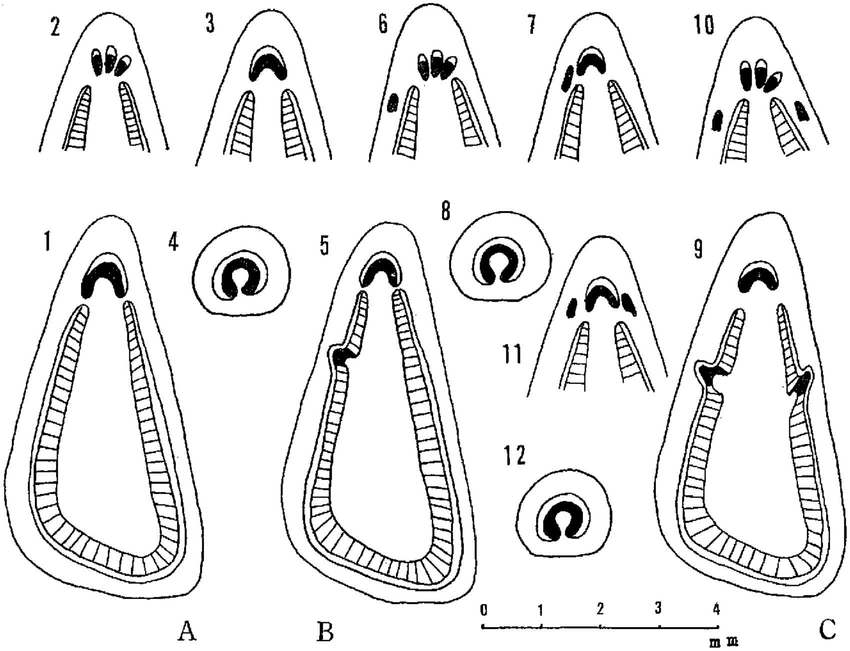

Fig. 4. *Poncirus trifoliata* Raf. A (1-4). Unilacunar type. B. (5-8). Bilacunar type. C (9-12). Trilacunar type. 4, 8 and 12. Basal end of the petiole.

cases, one of the two small traces is suppressed resulting the tetralacunar type (Fig. 2: C). These nodal types are constant in each branchlet of an individual.

Sorbus commixta Hedl. Though this species is of pentalacunar type (Fig. 3: A), tri- and tetralacunar types (Fig. 3: B, C, D) are also observed. All the types are found rather randomly from the lowest to the uppermost nodes of foliage leaves in each branchlet as follows: 5-5-5-5-5-5-5; 3-4-4-5-5-5; 3-5-5-5-3-4-3-5. These sequences are observed in one individual. The l_1 and l_2 traces of the tetra- and pentalacunar types are getting fused to one trace in the petiole, then from each resultant lateral trace a single stipular trace is set off.

Poncirus trifoliata Raf. The author observed 50 branchlets, and found that nearly a half of them show the unilacunar type (Fig. 4: A), and the rest shows the trilacunar one (Fig. 4: C). But sometimes nodes are of bilacunar type (Fig. 4: B). The trace of the unilacunar type consists of one strand which trichotomizes and again fuses into one arc at the base of the petiole (Fig. 4: A, 1-4).

The main trace of the bi- and trilacunar types also trichotomizes and again fuses into one arc associated with one or two lateral traces at the base of the petiole (Fig. 4: B, 5-8, and C, 9-12.). These nodal behaviours are constant in each branchlet, but these three types are found in one plant.

Remarks Three forms observed in *Lindera obtusiloba* suggest that there is a phylogenetic relationship between one gap—three strands form and one gap—one strand form which trichotomizes. The former is also observed in *Kadsura japonica*, and the latter in *Cerastium holosteoides* and *Parabenzoin praecox*.

In general lots of dicotyledons are reported to have an odd number of gaps. As mentioned above, however, *Sorbus commixta*, *Rubus palmatus* var. *coptophyllus*, and *Poncirus trifoliata* have an even number of gaps. In this concern the bilacunar type of *P. trifoliata* exhibits an intermediary between the unilacunar type and the trilacunar type, likewise, the tetralacunar type of *S. commixta*, and *R. palmatus* var. *coptophyllus* also exhibits the same between tri- and pentalacunar types. Attention should be focused to the tetralacunar type of the *S. commixta* (Fig. 3: B and C), in which the size of inter-region between the traces varies considerably.

Swamy (1949) reported the fact that the number of leaf traces in the Degeneriaceae varies considerably by the stage of ontogeny. That is, although the nodes of an adult stem are of pentalacunar type, the first few foliage leaves of the seedlings are of trilacunar type. A similar variation in the nodal type was reported by Canright (1955). For example, in the Magnoliaceae nodes of the first and second foliage leaves in seedlings show the trilacunar types, but at those of the upper leaves, traces increase additively. Furthermore numerous similar cases can be found in other families which in their adult stage have the trilacunar type, while nodes of the seedlings are of the unilacunar type as reported by Money and others (1950) for the Monimiaceae. However, there appears to be no report which demonstrate the variation of nodal types of branchlets in one plants or in a certain species.

Recently one gap—two strands form has been demonstrated in various dicotyledons. Many workers distinguished it from one gap—one strand form, and regarded the former as the most primitive form in the angiosperms. But studying carefully the author found many examples with the main trace consisting of three strands or one gap—one strand form which trichotomizes. There may be a need to confirm whether these types had derived from one gap—two strands form as

Canright stated in his paper. Even from the examples mentioned above only, it is clearly evident and must be emphasized that a careful observation is needed to determine a nodal type of a species based on a large number of nodes of branchlets from different individuals.

The author is deeply indebted to Dr. M. Mizushima for his kind direction.

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茎と葉の接合点である節は古い性質を残していると考えられている部分で，従って節型は安定した形質とされている。もちろん個体発生初期の子葉，第一葉，第二葉等の節型といわゆる普通葉の節型は違うということが知られているが，普通葉の節型は大きな分類群単位で一定（すなわちある科，または属のどの種をとっても同じ節型を示し，当然個体内での変異は存在しない）であると考えられていた。しかるに種によっては，一個体においてさえ普通葉の節型が節によって違う例を観察することが出来た。すなわち(1) ダンコウバイは単葉隙型で通常一個の葉隙から三本の独立した葉跡が生じるのであるが，その他に一葉隙から生じた一本の葉跡が三本に分れる場合と一葉隙から二本の葉跡が生じ，そのうちの一本が二本に別れる場合がある。同一の枝で各々を観察することが出来た。(2) モミジイチゴは通常三葉隙型であるが，ある株で五葉隙型，四葉隙型を観察することが出来た。以上の節型は枝ごとで一定していた。(3) ナナカマドは通常五

葉隙型であるが，その他に同一の枝で四葉隙型三葉隙型をも観察出来た。四葉隙型の中に側葉隙間の距離が様々に変化する例が存在した。(4) カラタチでは単葉隙型と三葉隙型をほぼ同じ割合で観察することが出来，時には二葉隙型も存在した。各々の節型は枝ごとに一定していた。これらの結果は節型を見極めるためには，多数の節を調査する必要があることを示している。今後同じ様な事実を見つけ出していくことが必要であり，こうすることによって種の節型が正しく決定されそれによって節型の系統をより正確に把握出来るのではなかろうか。

○高等植物分布資料 (45) Materials for the distribution of vascular plants in Japan (45)

○メリケンガヤツリ *Cyperus eragrostis* Lam. この和名は初島住彦，天野鉄夫両氏の，沖縄植物目録 (1958): 130 にでているのがはじめで，国立科学博物館には天野鉄夫氏採集の沖縄のもののほかに，1959年に上田豊氏が伊勢の四日市で採集されたもの，および数年前に黒川喬雄氏が京都の郊外，山科北花山で採集せられたものがある。この植物は北米西部から南米に分布する多年草で現在は南欧，ニュージーランドそのほかにひろく帰化している。全体はかなり大形になって，ややオニガヤツリににているが，鱗片は淡緑色であって，赤色をおびることはないから区別がつく。この学名は *Cyperus eragrostis* Vahl とまちがえられやすいが，それはカワラスガナのことである。　（大井次三郎）

○キソウラジロアザミ *Cirsium norikurense* Nakai var. *kisoense* Yamazaki et Asano 本誌 **40**: 4 (1965) に下伊那地方からキソウラジロアザミを報告したが，上伊那地方については標本がなく，小泉秀雄・横内斉氏が，上伊那でウラジロオクヤマアザミ？とよんでいるものが同じでないかとした。最近上伊那郡の越百山を流れる与田切川上流で採集した。また下伊那地方でもかなり広く分布しているので，下記の採集地を報告する。生育環境はいずれも河岸の陽性の砂礫地に発達する草むらである。上伊那郡: 七久保村上与田切川 1600 m (Aug. 12. 1962, no. 11114); 同 1650 m (no. 11059); 同中岳 1800 m (no. 11149). 飯田市大平黒川上流 1200 m (Aug. 2, 1965, no. 17123). 下伊那郡: 伊賀良村鳩打峠 (Sep. 14, 1952, no. 17122); 浪合村恩田大川入川 1300—1500 m (Sep. 1965, no. 20000); 同萱小屋川 1300—1600 m (Sep. 1965, no. 20101)

以上はすべて天竜川西側の木曽山脈とそのつづきである。さきに信濃教育会にある標本にもとづいて，天竜川東側の大鹿村地獄谷からも報告したが，大鹿村の植物にくわしい久保田秀夫氏は，まだこの植物を大鹿村でみたことがなくなにかのまちがいでないかといわれる。筆者も地獄谷付近はかなりあるいているが，キソウラジロアザミにであったことがない。天竜川の東側からはまだ知られていないといった方がよいようである。

（飯田市宮の前　浅野一男）